

Chip-Scale Precision Timing Unit for PicoSatellites

Completed Technology Project (2012 - 2016)



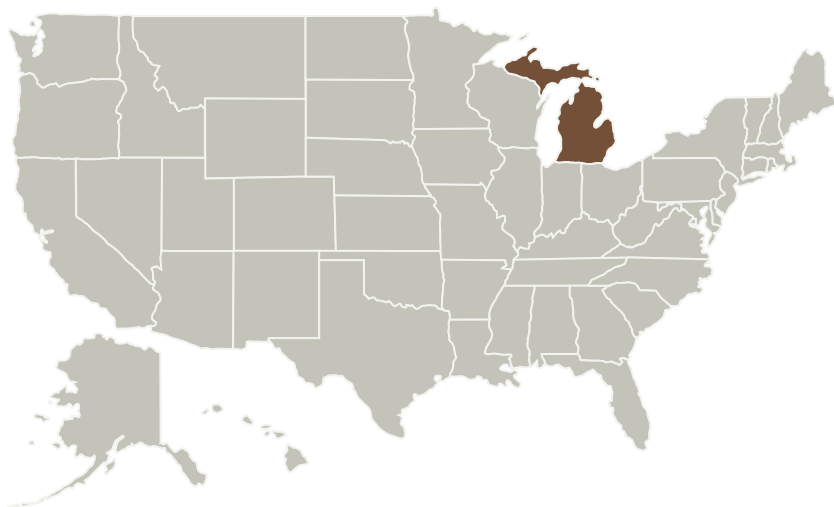
Project Introduction

This project intends to develop a chip-scale timing unit that offers an order of magnitude higher performance compared to existing solutions. Current Quartz-based clocks are not ideally suited to the high temperatures and extreme acceleration typical of space applications. The chip-scale precision clocks developed under this research offer reduced thermal sensitivity, and susceptibility to shock and acceleration using an array of micro-mechanical resonators with different temperature coefficient of frequencies. The resonators are passively compensated in a broad temperature range and offer a high quality factor and a small motional impedance, all characteristics required for achieving low-phase noise and low-power clocks. The resonators are placed in an array, and the frequency is estimated based on the weighted average output of the resonators with an accuracy that is at least an order of magnitude better than that of a single resonator clock. This research results in more precise mechanical clocks operating in space, thus can significantly impact NASA's autonomous platforms by enabling more precise landing and autonomous rendezvous.

Anticipated Benefits

This research results in more precise mechanical clocks operating in space, thus can significantly impact NASA's autonomous platforms by enabling more precise landing and autonomous rendezvous.

Primary U.S. Work Locations and Key Partners



Project Image Chip-Scale Precision Timing Unit for PicoSatellites

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Organizations Performing Work	Role	Type	Location
University of Michigan-Ann Arbor	Lead Organization	Academia	Ann Arbor, Michigan

Primary U.S. Work Locations
Michigan

Images

**11471-1363116891780.jpg**

Project Image Chip-Scale Precision Timing Unit for PicoSatellites
(<https://techport.nasa.gov/image/1728>)

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Michigan-Ann Arbor

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

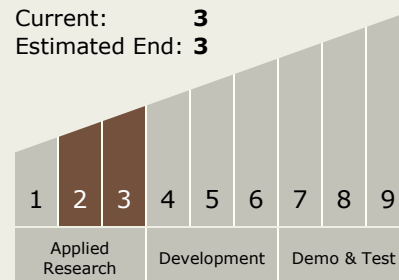
Hung D Nguyen

Principal Investigator:

Mina Rais-zadeh

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
 - └ TX05.1 Optical Communications
 - └ TX05.1.6 Optimetrics

Target Destination

Earth